



COPY OF PAPERS
ORIGINALLY FILED

The United States of America



The Commissioner of Patents and Trademarks

Has received an application for a patent for a new and useful invention. The title and description of the invention are enclosed. The requirements of law have been complied with, and it has been determined that a patent on the invention shall be granted under the law.

Therefore, this

United States Patent

Grants to the person(s) having title to this patent the right to exclude others from making, using, offering for sale, or selling the invention throughout the United States of America or importing the invention into the United States of America for the term set forth below, subject to the payment of maintenance fees as provided by law.

If this application was filed prior to June 8, 1995, the term of this patent is the longer of seventeen years from the date of grant of this patent or twenty years from the earliest effective U.S. filing date of the application, subject to any statutory extension.

If this application was filed on or after June 8, 1995, the term of this patent is twenty years from the U.S. filing date, subject to any statutory extension. If the application contains a specific reference to an earlier filed application or applications under 35 U.S.C. 120, 121 or 365(c), the term of the patent is twenty years from the date on which the earliest application was filed, subject to any statutory extension.

T. Todd Johnson

Commissioner of Patents and Trademarks

Melvinia Hany
Attest

United States Patent [19]

Sandhu



US006007408A

[11] Patent Number: 6,007,408
[45] Date of Patent: Dec. 28, 1999

[54] METHOD AND APPARATUS FOR ENDPOINTING MECHANICAL AND CHEMICAL-MECHANICAL POLISHING OF SUBSTRATES

[75] Inventor: Gurtej S. Sandhu, Boise, Id.

[73] Assignee: Micron Technology, Inc., Boise, Id.

[21] Appl. No.: 08/917,665

[22] Filed: Aug. 21, 1997

[51] Int. Cl.⁶ B24B 1/00

[52] U.S. Cl. 451/41; 451/7; 451/53

[58] Field of Search 451/7, 41, 53,
451/285, 289, 8, 6, 5, 526, 921, 488; 438/612,
604; 216/88, 89

5,369,488	11/1994	Morokuma	
5,413,941	5/1995	Koos et al.	
5,433,651	7/1995	Lustig et al.	
5,461,007	10/1995	Kobayashi	
5,465,154	11/1995	Levy	
5,597,442	1/1997	Chen et al.	451/7
5,609,719	3/1997	Hempel	
5,616,069	4/1997	Walker et al.	
5,643,050	7/1997	Chen	451/7
5,663,797	9/1997	Sandhu	
5,733,176	3/1998	Robinson et al.	451/41
5,762,537	6/1998	Sandhu et al.	451/7
5,777,739	7/1998	Sandhu et al.	
5,855,804	1/1999	Walker	

Primary Examiner—Robert A. Rose

Assistant Examiner—George Nguyen

Attorney, Agent, or Firm—Dorsey & Whitney LLP

[57]

ABSTRACT

An apparatus and method for stopping mechanical and chemical-mechanical polishing of a substrate at a desired endpoint. In one embodiment, a polishing machine has a platen, a polishing pad positioned on the platen, and a polishing medium located at a planarizing surface of the polishing pad. The polishing machine also has a substrate carrier that may be positioned over the planarizing surface of the polishing pad, and at least one heat sensor is coupled to the polishing machine to detect heat at a front side of the substrate. The heat sensor preferably measures a temperature of a component sensitive to heat at the front side of the substrate, such as the planarizing surface of the polishing pad, the back side of the substrate, or the byproducts produced by polishing the substrate. In operation, the heat sensor monitors the heat at the front side of the substrate, and the removal of material from the substrate is stopped when the heat at the front side of the substrate changes from a first heat range to a second heat range.

13 Claims, 4 Drawing Sheets

[56] References Cited

U.S. PATENT DOCUMENTS

4,200,395	4/1980	Smith et al.
4,203,799	5/1980	Sugawara et al.
4,358,338	11/1982	Downey et al.
4,367,044	1/1983	Booth, Jr. et al.
4,377,028	3/1983	Imahashi
4,422,764	12/1983	Eastman
4,640,002	2/1987	Phillips et al.
4,660,980	4/1987	Takabayashi et al.
4,717,255	1/1988	Ulbers
4,879,258	11/1989	Fisher
5,036,015	7/1991	Sandhu et al.
5,064,683	11/1991	Poon et al.
5,069,002	12/1991	Sandhu et al.
5,081,796	1/1992	Schultz
5,154,021	10/1992	Bombardier et al.
5,216,843	6/1993	Breivogel et al.
5,220,405	6/1993	Barbee et al.
5,314,843	5/1994	Yu et al.
5,324,381	6/1994	Nishiguchi

